16. **Proposed by B. F. FINKEL, A. M., Professor of Mathematics in Kidder Institute, Kidder, Missouri.**

What is the average volume common to a cube and a rectangular solid one inch square, the axis of rectangular solid being equal to and coinciding with the diagonal of the cube?

Solutions to these problems should be received on or before September 1st.

MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

8. **Proposed by H. C. WHITAKER, B. S., M. E., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.**

Find a general expression for the (integral) co-ordinates of a triangle with sides of integral lengths.

Solution by the PROPOSER.

My own method of solving this problem has been to take the three equations $y=\frac{a}{b}x$, $y=\frac{c}{d}x$, and $y=\frac{e}{f}x+g$, and eliminating x and y solve for g; a and b, c and d, e and f being $\pm$ sides of right triangles.

The sides I usually take for triangles have lengths (39, 34, 25), (13, 45, 40), (10, 39, 35). I am in the habit of giving a whole group of problems with the same triangle to be worked out consecutively; *e. g.*, Find, (1), length of each side; (2) equations of each side, (3), length each altitude; (4), sine each angle; (5), area; (6), equation of bisectors of each angle; (7), position of centers of inscribed and escribed circles; (8), their radii, and so on.

Another day I give something like this; A $\triangle$ has its vertices at (5, 10), (6, 4) and (3, 2), find, (1), the equations of the sides; (2), the equations of the altitudes; (3), the point of intersection of the altitudes; (4), the co-ordinates of the middle point of each side; (5), the equations of the medians; (6), the intersection of same; (7), the equations of perpendiculars through middle points of each side; (8), their intersection; (9), the equation of line through (3), (6) and (8).

9. **Proposed by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.**

Wires of five different metals A, B, C, D, E, having resistances a, b, c, d, e, have their ends soldered together at two junctions which are maintained at different constant temperatures. If the strength of current in E, when all five wires are continuous, is S, the strength of current when B, C, D, are cut is S_a, the strenth of current when A, C, D, are cut is S_b, the strength of current when A, B, D, are cut is S_c, find the strength of current S_x, when A, B, C, are cut.

Solution by the PROPOSER.

Let l, m, n, o, p, q be the potentials of the wires and solder at the junction P. l', m', n', o', p', q' the potentials of the wires and solder at the junction Q.

Let v, w, x, y, S be the currents in A, B, C, D, E supposed to be going from P to Q.

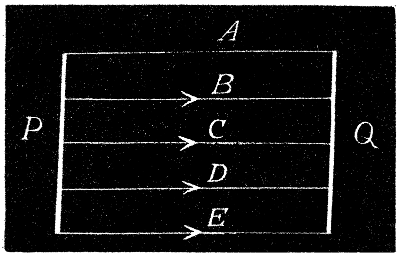
The electromotive force in the wire A is $(l'-q')-(l-q)$ and by Ohm's law this is equal to the product of the resistance into the current.

$\therefore (l'-q')-(l-q)=av$ or $l'-l-av=q'-q$.

Similarly
$$m'-m-bw=q'-q,$$
$$n'-n-cx=q'-q,$$
$$o'-o-dy=q'-q,$$
$$p'-p-eS=q'-q.$$

Also $v+w+x+y+S=0$ by symmetry.

Similarly $l'-l+aS_a=p'-p-eS_a$,
$$m'-m+bS_b=p'-p-eS_b,$$
$$n'-n+cS_c=p'-p-eS_c,$$
$$o'-o+dS_x=p'-p-eS_x.$$



Therefore

$eS-av=(a+e)S_a$ or $bcdeS-abcdv=bcd(a+e)S_a$,

$eS-bw=(b+e)S_b$ or $acdeS-abcdw=acd(b+e)S_b$,

$eS-cx=(c+e)S_c$ or $abdeS-abcdx=abd(c+e)S_c$,

$eS-dy=(d+e)S_x$ or $abceS-abcdy=abc(d+e)S_x$.

Therefore $(bcde+acde+abde+abce)S-abcd(v+w+x+y)=bcd(a+e)S_a+acd(b+e)S_b+abd(c+e)S_c+abc(d+e)S_x$ but $v+w+x+y=-S$.

$$\therefore S_x=[(abcd+bcde+acde+abde+abce)S-abcd(S_a+S_b+S_c)-bcdeS_a-acdeS_b-abdeS_c]\div abc(d+e).$$

PROBLEMS.

---

13. Proposed by CHARLES E. MYERS, Canton, Ohio.

A soap bubble 2 inches in diameter, is filled with one part of hydrogen gas and 15 parts of air. If the bubble just floats in the air, find the thickness of the film.

14. Proposed by COOPER D. SCHMITT, Professor of Mathematics, University of Tennessee, Knoxville, Tennessee.

I have a glass paper-weight in the form of a regular icosahedron. I let the sun's rays fall upon it, at various angles, also upon one of the vertices. How many complete spectra will be formed? How many will be of white light? What position will give maximum number of spectra?

15. Proposed by SAMUEL HART WRIGHT, M. D., M. A., Ph. D., Penn Yan, Yates Co., New York.

Required the illuminated area of the Moon's disc when $\frac{2}{3}$ through its first quarter, or 60° of longitude east of the Sun, the Earth and Moon being at their mean distances.

Solutions to these problems should be received on or before September 1st.